GUIDANCE, NAVIGATION & CONTROL

Peter Maybeck
Professor
PhD, Massachusetts Institute of Technology, 1972

- Multiple model adaptive estimation and Kalman filtering
- Optimal estimation and stochastic control
- Optimally aided inertial navigation systems
- Event detection and adaptive estimation for target tracking, sensor/ actuator failures, GPS jamming/ spoofing, and adaptive control

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Mikel Miller
Assistant Professor
PhD, Air Force Institute of Technology, 1998

- Personal Navigation and Physiological Monitoring
- Optimally aided inertial navigation systems with GPS
- Autonomous vehicle navigation, guidance and control
- Multiple model adaptive estimation and Kalman filtering

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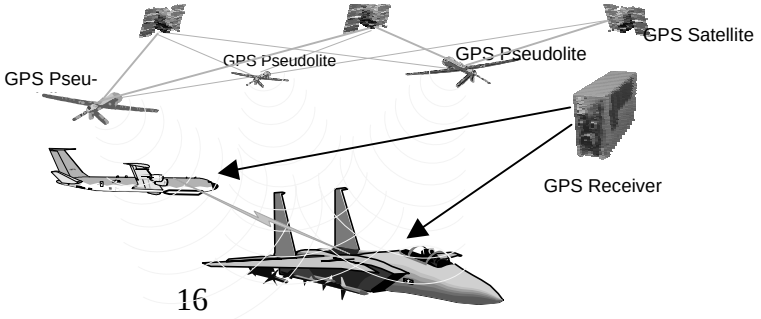
In the GNC research group, faculty members teach and perform research on the broad range of systems which gather, process, distribute, and act on information affecting the guidance, navigation & control of aerospace vehicles. Our unique ability to combine theoretical studies and practical application allows the GNC group to handle projects from concept to demonstration with a minimum investment of both time and money. Our major commitment is to improving the performance and reliability of aerospace systems by discovering applicable solutions to a broad range of aviation-related issues. We accomplish this goal through pursuing avionics-related research and through educating and training future aviation-electronics professionals.

Areas of interest include the traditional disciplines of guidance, navigation, and control, as well as an increasing emphasis on adaptive and optimal estimation, optimally aided navigation systems using the Global Positioning System (GPS), adaptive and reconfigurable flight control, and autonomous vehicle guidance and control. Ongoing research includes: tightly coupled navigation systems, command and control of multiple unmanned/ autonomous vehicles (UAVs), and the development nonlinear flight control, system identification and statistical signal processing.

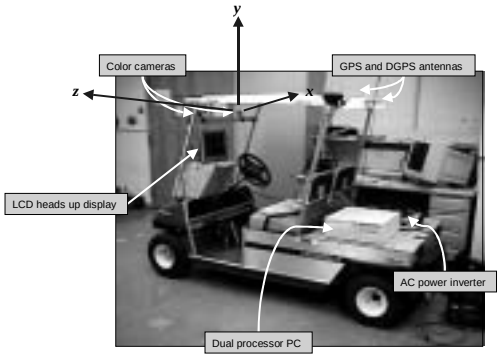
The entire GNC group is involved with many aspects of GPS research. We are leading efforts to attain centimeter-level GPS positioning accuracy for both sensor vehicles and weapons. This research includes developing algorithms for robust precise GPS



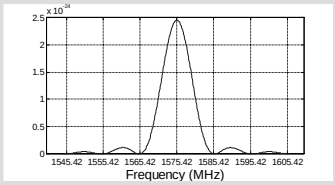
positioning in a wartime environment and accurately characterizing the nature of GPS errors in the aerospace environment, and exploiting networks of GPS reference receivers to remove GPS errors. We are also studying the effect of jamming on GPS receivers, and developing methods for precisely locating even low-power GPS jammers.

The GNC group is also conducting fruitful research in multiple model adaptive estimation and control as applied to Air Force systems. Graduate research is actively investigating the application of multiple model algorithms to sensor/actuator failure detection and controller reconfiguration for survivable flight controller design, the detection and compensation for multiple soft and hard failures in flight control sensors and actuators, and adaptive prediction of head motion for virtual environment flight simulators to remove the effect of computational and scene-rendering delay time. In addition, exciting research is being concentrated on ultra-tight coupling of micro-electro-mechanical system (MEMS) inertial systems and GPS for smart miniature munitions, micro-UAVs, adaptive compensation for multipath effects in GPS, and to the detection and compensation of interference/jamming/spoofing of GPS-aided inertial navigation systems.

Finally, the GNC group has strong interests in the application of mathematics to the solution of engineering and scientific problems. They are conducting cutting-edge research in non-linear flight control, autonomous control of UCAVs and the theory of differential games and guidance.



RAVEN – Remote-sensing Autonomous Vehicle



Meir Pachter
Professor
PhD, Israel Institute of Technology, 1975

- Automatic control of aircraft and missiles
- Adaptive control and system identification
- Inertial and GPS Navigation
- Autonomous control/neural networks/fuzzy logic control, non-linear control

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John Raquet
Assistant Professor
PhD, University of Calgary, 1998

- Precision differential GPS
- Reference receiver networks
- Advanced GPS receiver technology
- GPS jamming detection and mitigation

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